III. RESPONSE TO THE OFFICE ACTION

A. General Remarks

Claims 1-19 were pending in the application prior to this submission. Claims 1-5, 11-13, and 19 have been canceled. New claim 20 has been added. Therefore, claims 6-10, 14-18, and 20 are now pending.

Claims 6-10 and 14-18 have been amended. Marked-up versions of the claims are submitted in an Attachment to this paper. If there is any discrepancy between the amendments contained in this paper and the enclosed marked-up versions, Applicant request that the amendments of this paper be considered controlling.

Amendments to the claims are fully supported by the originally filed disclosure as follows:

1. Amended claims 6-10 and 14-18 are directed to a switched reluctance machine. Support for this amendment can be found throughout the original specification and, for example, in the paragraph on page 2, ll. 15-22.
2. Amended claim 6-10 and 14-18 have been amended to require "salient rotor poles." Claims 6, 14, and 18 have been amended to require that the rotor poles are "substantially equally spaced about the rotor." Claim 7 has been amended to require that "each rotor pole of the first pair having a first pole face construction and a first angular width substantially similar to the other radially opposed pole of the pair" and to require that "each rotor pole of the second pair having a second pole face construction and a second angular width substantially similar to the other radially opposed pole of the pair." Support for these amendments can be found throughout the original specification and, for example, in Figures 5A, 7A, 8A-C, 9A-L, 10, 11A-D, 12C, 13-20, 21A-L and associated written description.
3. Amended claim 6-10 and 14-18 have been amended to require "salient stator poles." Claim 6, 14, and 18 have been amended to required that the stator defines stator poles that are "substantially equally spaced about the stator." Claim 14 has been amended to require that "a first pair of salient

stator poles being radially opposed to one another and having a first pole face construction substantially similar to one another" and that "a second pair of salient stator poles being radially opposed to one another and having a second pole face construction substantially similar to one another." Support for these amendments can be found throughout the original specification and, for example, in Figures 5A, 7A, 8A-C, 9A-L, 10, 11A-D, 12C, 13-20, 22A-C, 24, 26 and associated written description.

Additional amendments to the claims have been made to merely improve the grammatical reading of the claims and are fully supported by the originally filed disclosure as follows:

1. Throughout the claims, the wording of "a plurality of energization cycles" has been amended to read --a plurality of discrete intervals-- for clarity.
2. Throughout the claims, the wording of "pole face" has been amended to read --pole face construction-- and the wording "construction" has been amended to read --pole face construction-- for clarity.
3. Throughout the claims, the word "during" has been replaced with --over-- for clarity.
4. Throughout the claims, the words --first-- and --second-- have been added for clarity.
5. Claim 18 has been rewritten in independent form including all of the limitations of the former base claim (amended claim 14) for clarity.

B. Specific Comments

1. First Set of Rejections under 35 U.S.C. § 103

In paragraphs 1-3 of the Office Action, claims 1-3 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata in view of Keljik; claim 4 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata in view of Keljik as applied to claim 2 above, and further in view of Cho; and claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata in view of Keljik as applied to claim 1 above, and further in view of Delson et al.

Claims 1-5 have been cancelled. In light of these amendments, Applicant respectfully requests that the Examiner withdraw the rejections of claims 1-5 under 35 U.S.C. §103.

2. Second Set of Rejections under 35 U.S.C. § 103

a. In paragraph 4 of the Office Action, claims 6-8 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka in view of Keljik.

Claim 13 has been cancelled. Applicant submits that amended claims 6-8 contain limitations that are not disclosed or suggested by the cited references, alone or in combination. Firstly, claim 6, from which claims 7-8 depends, is directed to "a switched reluctance machine" and requires "salient rotor poles" and "salient stator poles." In stark contrast to the claimed invention, Uzuka is directed to DC motors having permanent magnets for poles of the rotor and having coils for poles of the stator. Secondly, Keljik merely describes the phenomenon of attraction and repulsion of magnetic poles and fails to provide the limitations missing from Uzuka.

b. In paragraph 5 of the Office Action, claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka in view of Keljik as applied to claim 8 above, and further in view of U.S. Patent 5,701,064 to Horst et al. (Horst '064).

Applicant submits that amended claim 9 contains limitations that are not disclosed or suggested by the cited references, alone or in combination. Firstly, as noted above, Uzuka in view of Keljik fails to disclose limitations required by independent claim 6, from which claim 9 depends. Secondly, Horst '064 is directed to sensing rotor position in a machine by coupling an energized stator winding with a de-energized stator winding and processing a resultant circulating current waveform. Horst '064 merely discloses that:

> Ideally, the air gap is uniform about the circumference of the rotor and stator. In reality, it is not. Rather, as shown in FIG. 2, an air gap G1 between respective stator and rotor teeth 18a and 22a, is of a different width than a gap G2 between teeth 18b and 22b. In investigating the effects of this non-uniformity, it has been found that a current waveform Cw resulting from current flow in an energized phase winding and coupled into the non-energized or de-energized windings has a current signature. Further, it has been found that this current signature can be used to detect rotor position. As a result, there is no need for a separate rotor sensor to be incorporated into the machine or machine housing. [Horst '064 at col. 5, ll. 18-30]

Thus, Horst '064 merely points out that the air gap G1 between one stator and one rotor pole 18a and 22a is in reality different from a gap G2 between an adjacent stator pole 18b and rotor pole 22b. Horst '064 does not disclose or suggest that radially opposed pairs of rotor poles establish different maximum air gaps with at least one radially opposed pair of stator poles. Therefore, Horst '064 does not disclose or suggest that "a first maximum air gap established between ***the first pair of rotor poles and the at least one pair of stator poles*** is different from a second maximum air gap established between ***the second pair of rotor poles and the at least one pair of stator poles***," as required by claim 9.

c. In paragraph 6 of the Office Action, claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka in view of Keljik and further of Horst '064 as applied to claim 9 above, and further in view of Habermann.

Applicant submits that amended claim 10 contains limitations that are not disclosed or suggested by the cited references, alone or in combination. Firstly, as noted above, Uzuka in view of Keljik fails to disclose limitations required by independent claim 6, from which claim 10 indirectly depends. Secondly, Habberman merely discloses "a

device for measuring the induction in the air gap of a magnetic bearing" (Abstract) and fails to provide the limitations missing from Uzuka, Keljik, and Horst '064 noted above.

d. In paragraph 7 of the Office Action, claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka in view of Keljik as applied to claim 6 above, and further in view of Delson et al.

Claims 11-12 have been cancelled.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Uzuka, Keljik, Horst '064, and Habermann cannot render Applicant's claims 6-10 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations. For at least the reasons presented above, Applicant respectfully requests that the Examiner reconsider and withdraw the rejection of claims 6-10 under 35 U.S.C. § 103(a) and indicate the allowance of these claims in the next paper from the Office.

3. <u>Third Set of Rejections under 35 U.S.C. § 103</u>

a. In paragraphs 8 of the Office Action, claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik.

Applicant submits that amended, independent claim 14 contains limitations that are not disclosed or suggested by the cited references, alone or in combination. Firstly, claim 14 is directed to "a switched reluctance machine" and requires "salient rotor poles" and "salient stator poles." In stark contrast to the claimed invention, E. R. Lang is directed to a step motor for use with an indicator and discloses permanent magnet poles on the rotor. Secondly, Keljik merely describes the phenomenon of attraction and repulsion of magnetic poles and fails to provide the limitations missing from E. R. Lang.

b. In paragraphs 9 of the Office Action, claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik as applied to claim 14 above, and further in view of Uzuka.

Applicant submits that amended, independent claim 18 contains limitations that are not disclosed or suggested by the cited references, alone or in combination. Firstly, claim 18 is directed to "a switched reluctance machine" and requires "salient rotor poles" and "salient stator poles." In stark contrast to the claimed invention and as noted above, E. R. Lang is directed to a step motor for use with an indicator and discloses permanent magnet poles on the rotor. Secondly, Uzuka is directed to a DC motor and discloses permanent magnets for poles of the rotor and coils for poles of the stator and fails to provide the limitations missing from E. R. Lang and Keljik. Lastly, Keljik merely describes the phenomenon of attraction and repulsion of magnetic poles and fails to provide the limitations missing from E. R. Lang and Uzuka.

c. In paragraphs 10 of the Office Action, claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik as applied to claim 14 above, and further in view of Nitta.

Applicant submits that amended claim 15 contains limitations that are not disclosed or suggested by the cited references, alone or in combination. Firstly, as noted above, E. R. Lang in view of Keljik fails to disclose limitations required by independent claim 14, from which claim 15 depends. Secondly, Nitta discloses a permanent magnet motor having permanent magnets for poles of the rotor and fails to provide the limitations missing from E. R. Lang and Keljik.

d. In paragraphs 11 of the Office Action, claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik and further of Nitta as applied to claim 15 above, and further in view of U.S. Pat. No. 5,670,836 to Horst (Horst '836).

Applicant submits that amended claims 16-17 contain limitations that are not disclosed or suggested by the cited references, alone or in combination. Firstly, as noted above, E. R. Lang in view of Keljik and further of Nitta fail to disclose limitations required by independent claim 14, from which claim 16-17 depends. Secondly, Horst

'836 discloses a permanent magnet motor having permanent magnets for poles of the rotor and fails to provide the limitations missing from E. R. Lang, Keljik, and Nitta.

e. In paragraphs 12 of the Office Action, claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik as applied to claim 14 above, and further in view of Delson et al.

Claim 19 has been cancelled.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of E. R. Lang, Keljik, Nitta, Uzuka, and Horst '836 cannot render Applicant's claims 14-18 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations. For at least the reasons presented above, Applicant respectfully requests that the above rejection of claims 14-18 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office.

* * * *

In order to facilitate the resolution of any issues or questions presented by this paper, Applicant respectfully requests that the Examiner directly contact the undersigned by phone to further the discussion, reconsideration, and allowance of the claims.

Respectfully submitted,

Date: May 14, 2003

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ATTACHMENT

MARKED-UP VERSION OF CLAIMS AS AMENDED BY THIS RESPONSE

1-5. (Cancelled)

6. (Currently Amended) ~~An electromagnetic~~ A switched reluctance machine, comprising:

a rotor defining a plurality of salient rotor poles substantially equally spaced about the rotor, each rotor pole having a pole face construction and defining an angular width, wherein the angular width of the rotor pole with the widest width is:

(c) substantially equal to or greater than the angular width of the rotor pole with the narrowest width, and

(d) less than 1.5 times the angular width of the rotor pole with the narrowest width;

a stator defining at least ~~two~~ one pair of salient stator poles, ~~that are~~ the stator poles of the at least one pair being radially opposed to one another and having substantially the same pole face construction as one another;

a phase winding ~~positioned such that, when current is flowing in the phase winding, the at least two stator poles are energized; and~~

~~a circuit~~ for energizing the ~~phase winding~~at least one pair of stator poles over a plurality of ~~energization cycles~~discrete intervals, the energizing of the phase winding ~~to produce~~producing a given desired output on the rotor~~, the energizing of the phase winding also~~ and producing ~~a~~ normal ~~force~~ forces tending to cause movement of the ~~at least two~~energized stator poles towards the rotor;

wherein ~~the~~ a first profile of the normal forces ~~profile~~ experienced by the at least ~~two~~ one pair of stator poles over a first ~~energization cycle~~discrete interval is different from a subsequent profile of the normal forces

~~profile~~ experienced by the at least ~~two~~ one pair of stator poles over a subsequent ~~energization cycle~~discrete interval.

7. (Currently Amended) The ~~electromagnetic~~ switched reluctance machine of claim 6, wherein the rotor defines a plurality of pairs of ~~opposing~~ salient rotor poles, the salient rotor poles in each pair being radially opposed to one another, and wherein:

a) ~~during~~ over the first ~~energization cycle~~discrete interval, a first pair of ~~opposing~~ rotor poles is brought towards alignment with the at least ~~two~~ one pair of stator poles, each rotor pole of the first pair having a first pole face construction and a first angular width substantially similar to the other radially opposed pole of the pair;

b) over the ~~second energization cycle~~subsequent discrete interval, a second radially opposed pair of ~~opposing~~ salient rotor poles is brought towards alignment with the at least ~~two~~ one pair of stator poles, each rotor pole of the second pair having a second pole face construction and a second angular width substantially similar to the other radially opposed pole of the pair; and

c) the first pole face construction of the rotor poles forming the first pair ~~of opposing rotor poles~~ is different from the second pole face construction of the rotor poles forming the second pair ~~of opposing rotor poles~~.

8. (Currently Amended) The ~~electromagnetic~~ switched reluctance machine of claim 7, wherein the first angular width of the rotor poles forming the first pair ~~of opposing rotor poles~~ is substantially the same as the second angular width of the rotor poles forming the second pair ~~of opposing rotor poles~~.

9. (Currently Amended) The ~~electromagnetic~~ switched reluctance machine of claim 87, wherein a first maximum air gap established between the first pair of ~~opposing~~ rotor poles and the at least ~~two~~ one pair of stator poles is different from ~~the~~ a second maximum

air gap established between the second pair of ~~opposing~~ rotor poles and the at least ~~two~~ one pair of stator poles.

10. (Currently Amended) The ~~electromagnetic~~ switched reluctance machine of claim ~~97~~, wherein ~~maximum air gap established between the first pair of opposing rotor poles and the at least two stator poles is defined by a notch in the profile of the face of the rotor pole~~ each of the rotor poles of the first pair having the first pole face construction defines a notched pole face.

11-13. (Cancelled)

14. (Currently Amended) ~~An electromagnetic~~ A switched reluctance machine, comprising:

a rotor defining a plurality of salient rotor poles substantially equally spaced about the rotor, each rotor pole having a pole face construction and ~~defining~~ an angular width, wherein the angular widths of each of the rotor poles are substantially the same;

a stator defining a plurality of salient stator poles substantially equally spaced about the stator, the plurality of salient stator poles forming:

~~defining~~ a first ~~set of opposing~~ pair of salient stator poles being radially opposed to one another and having a first pole face construction substantially similar to one another, and

a second ~~set of opposing~~pair of salient stator poles being radially opposed to one another and having a second pole face construction substantially similar to one another; ~~each of the stator poles being associated with~~

at least one current carrying member ~~such that a stator pole is energized when current is flowing through a current carrying member associated with the stator pole; and~~

~~a circuit for energizing the at least one current carrying member over a given interval so as to~~for simultaneously ~~energize~~energizing the first and second ~~sets of opposing~~pairs of stator poles over a plurality of discrete intervals; the energizing of the current carrying member producing a given desired output on the rotor ~~also~~and producing normal forces tending to cause movement of the energized stator poles towards the rotor;

wherein a first profile of the normal forces ~~profile~~ experienced by the first pair of ~~opposing~~ stator poles over ~~the given~~one of the discrete intervals is substantially different from a second profile of the normal forces ~~profile~~ experienced by the second pair of ~~opposing~~ stator poles over the ~~given~~ same discrete interval.

15. (Currently Amended) The ~~electromagnetic~~ switched reluctance machine of claim 14, wherein the first pole face construction of the stator poles ~~comprising~~ forming the first ~~set of opposing stator poles~~ pair is different from the second pole face construction of the stator poles ~~comprising~~ forming the second ~~set of opposing stator poles~~pair.

16. (Currently Amended) The ~~electromagnetics~~switched reluctance machine of claim 15, wherein each of the stator poles ~~in~~ of the first ~~set of opposing stator poles~~pair having the first pole face construction defines a notched ~~surface~~pole face.

17. (Currently Amended) The ~~electromagnetics~~switched reluctance machine of claim 16, wherein the pole face construction of each of the rotor poles is substantially the same.

18. (Currently Amended) ~~The electromagnetic machine of claim 14,~~ A switched reluctance machine, comprising:

a rotor defining a plurality of salient rotor poles, the plurality of salient rotor poles substantially equally spaced about the rotor and having substantially the same angular width as one another, the plurality of salient rotor poles forming:

a first pair of salient rotor poles being radially opposed to one another and having a first pole face construction substantially similar to one another, and

a second pair of salient rotor poles being radially opposed to one another and having a second pole face construction substantially similar to one another, the second pole face construction being different from the first pole face construction;

a stator defining a plurality of salient stator poles substantially equally spaced about the stator and having substantially the same pole face construction as one another ~~wherein the construction of the stator poles comprising the first set of opposing stator poles is substantially the same as the construction of the stator poles comprising the second set of opposing stator poles~~, the plurality of salient stator poles forming a first pair of salient stator poles being radially opposed to one another and forming a second pair of salient stator poles being radially opposed to one another; and ~~wherein:~~

at least one current carrying member for simultaneously energizing the first and second pairs of salient stator poles over a plurality of discrete intervals, the energizing of the at least one current carrying member producing a given desired output on the rotor and producing normal forces tending to cause movement of the energized stator poles towards the rotor,

wherein ~~during the given interval, a~~the first pair of ~~opposing~~ rotor poles having the first pole face construction is brought towards alignment with the first ~~set~~ pair of ~~opposing~~ stator poles over one discrete interval;

wherein ~~during the given interval, a~~ the second pair of ~~opposing~~ rotor poles having the second pole face construction is brought towards alignment with the second ~~set~~ pair of ~~opposing~~ stator poles over the same discrete interval; and

~~the construction of the poles forming the first pair of opposing rotor poles is different from the construction of the poles forming the second pair of opposing rotor poles~~

wherein a first profile of the normal forces experienced by the first pair of stator poles over the one discrete interval is substantially different from a second profile of the normal forces experienced by the second pair of stator poles over the same discrete interval.

19. (Cancelled)

20. (New) The switched reluctance machine of claim 6, wherein each of the stator poles forming the at least one pair defines a notched pole face.